kangaroo® pet™

Ambulatory Enteral Feeding Pump

service manual

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1. general information

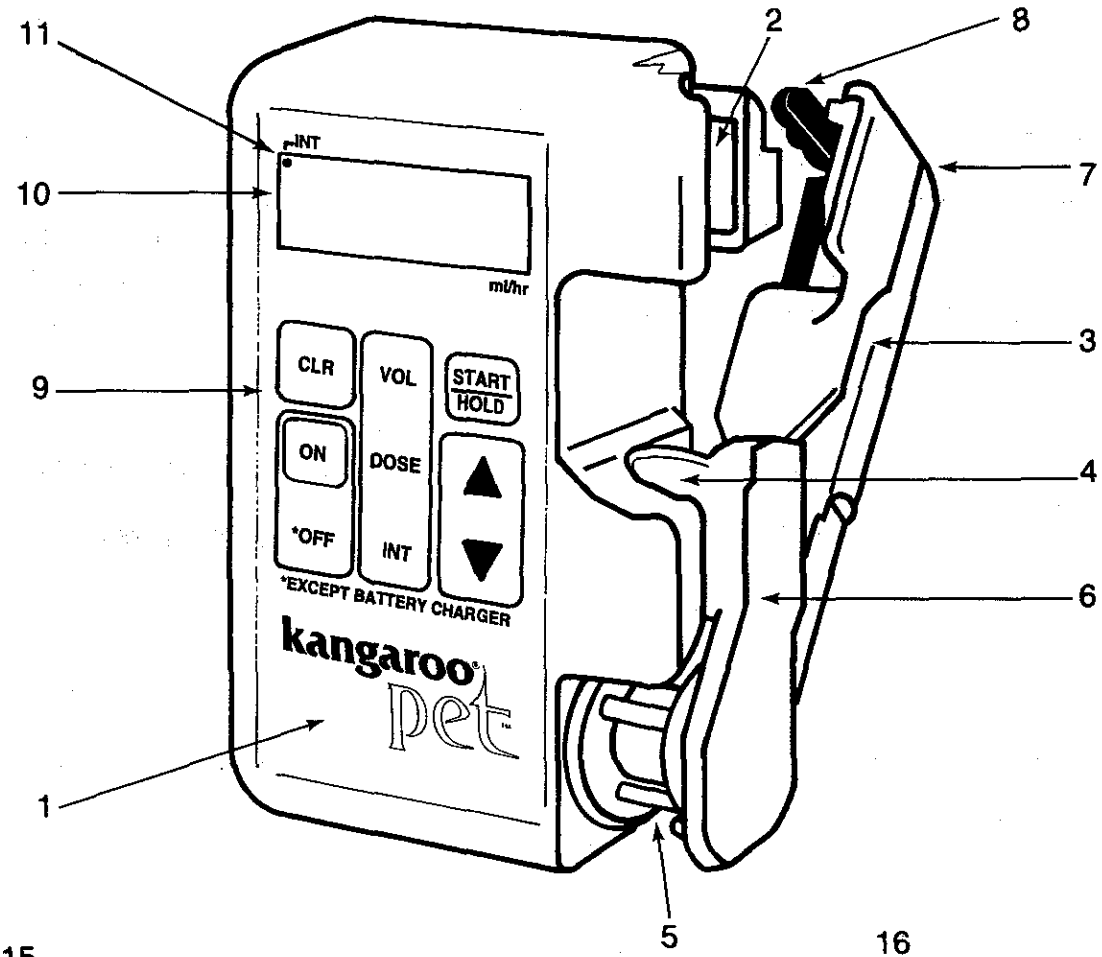
product description

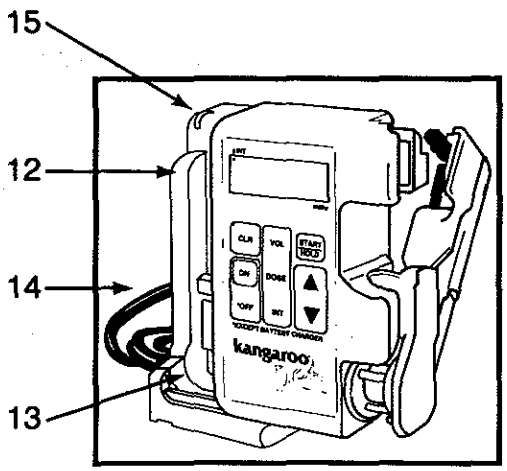
The Sherwood Medical Kangaroo Pet Feeding Pump is a rotary peristaltic pump designed to regulate the flow rate of enteral feedings. Some of the features provided by this pump are:

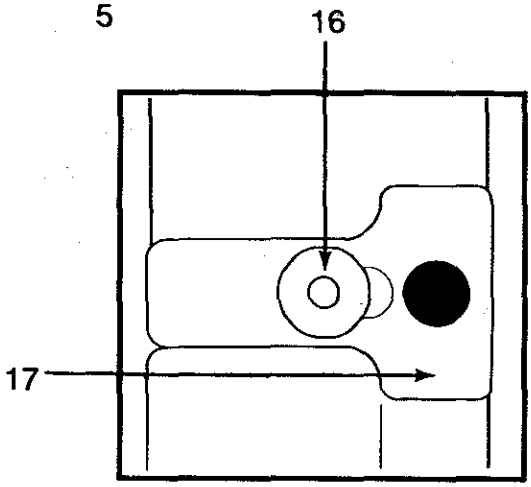
- Portable operation—built in battery.
- Intelligent battery charging for longer operating times and extended lifetime.
- Small and lightweight for easy transport.
- Carrying case and frame for ambulatory or tabletop use.
- Touch panel operation.
- Pumping shut off and activation of audible and visible alarms when:
  - —Feeding container is empty
  - —Feeding tube becomes occluded
  - —Drop sensors blocked
  - —Battery low (alarms 15 minutes before pump shut off)
  - —Unit is left on "HOLD" longer than 2½ minutes
  - —Pump set is improperly loaded
  - —Self diagnosed problem which requires technical servicing, including battery defective
  - —Preset dose has been delivered
  - —Pump motor malfunction
- Periodic systems check after pump has been turned on.
- Large LED display.
- Detachable charger base.
- Low occlusion pressure. Pump will not overcome back pressure greater than approximately 12 psi (82.7 kPa) nominal, 15 PSI peak (103 kPa).
- Integral pole clamp on charger base.
- Use of safety interlock pump sets to safeguard against the risk of over-infusion due to misloading of pump set onto pump.
- Pump running indicator LEDs.
- Volume delivered totalizer.
- Programmable dose to be delivered.
- Programmable dose repetition timer.

WARNING—This Kangaroo Pet Pump requires the use of a Kangaroo Pump Set. The pump will not operate if sets other than Kangaroo Pump Sets are loaded onto the pump.

1. Pump
2. Upper Drip Chamber Guide
3. Tubing Guide
4. Lower Drip Chamber Guide
5. Rotor
6. Rotor Cover
7. Loading Arm
8. Arm Latch
9. Keypad
10. Display
11. Intermittent Feeding Indicator
12. Charger Base
13. Release Latch
14. Power Cord
15. AC Light
16. Pole Clamp Knob
17. Pole Clamp (back view)







2. maintenance

routine maintenance

Routine maintenance consists primarily of preventing and cleaning spillage on the housing, rotor and rollers.

> **CAUTION: Disconnect the pump from the AC power source before cleaning to prevent electrical shock.**

cleaning

—Disconnect charger base from AC power source before cleaning
—Do not immerse pump in cleaning solution
—A mild detergent or isopropyl alcohol may be used for general cleaning.
—If necessary, a hypochlorite solution (10 parts water to 1 part household bleach) can also be used for cleaning the pump; however, repeated cleaning with this solution can damage the plastic and labelling of the pump and charger base.

housing

—Clean outside surfaces with a damp cloth or sponge; wring cloth or sponge thoroughly to remove excess moisture
—Avoid excess moisture near drop detector, loading arm bearing, and pump and charger base connectors
—Keep pump and charger base upright as much as possible

drop detector

—Clean the drop sensors in the upper drip chamber guide with cotton swabs and isopropyl alcohol
—Be sure sensor areas are clear

rotor assembly

—Remove two rotor shield screws with a Phillips screwdriver and lift the rotor shield away from the rotor
—Loosen rotor set screw with a $5/64''$ allen wrench and gently pull rotor forward off shaft
—Clean rollers thoroughly with warm soapy water, or isopropyl alcohol if necessary
—Be sure all parts of rotor are completely dry before putting it back onto shaft
—To replace rotor, align set screw on hub of rotor with the flattened section of the motor shaft
—Push rotor into place and tighten set screw (DO NOT OVERTIGHTEN)
—Place the rotor shield into its proper position and tighten the two screws that hold it in place (DO NOT OVERTIGHTEN)

2. maintenance (cont.)

CARE SHOULD BE TAKEN THAT NO SOLUTION GETS INSIDE THE PUMP, AS DAMAGE TO ELECTRICAL COMPONENTS COULD RESULT. PROLONGED EXPOSURE TO ALCOHOL OR OTHER STRONG CLEANSERS COULD RESULT IN DAMAGE TO THE PUMP HOUSING.

calibration

There is no calibration required for the Kangaroo Pet pump.

additional tests

Motor speed can be verified by measuring the time elapsed from when the motor starts turning, stops, and then starts turning again.

Motor cycle time is as follows:

	Time (seconds)	
RATE (ml/hr)	**in backpack**	**NOT in backpack**
10	41.040	45.000
50	8.208	9.000
125	9.850	10.800
300	4.104	4.500
400	3.078	3.375

The tolerance for all cycle times is +/– 0.025 seconds when measuring with electronic instruments. Manual stopwatch measurements are not recommended due to lack of accuracy and consistency. A tolerance of +/– 0.25 seconds is allowed for manual measurement.

Pressing the CLR key while simultaneously turning the pump on with the ON key will result in the pump's language setting and software copyright and version number to be displayed before normal operation begins. The language display text is shown in the **language selection** portion of the **circuit description** of the **ambulatory pump**.

alarms

Internal Circuit Problem Alarm

The pump will alarm and display "8'8'8'8'" if an internal circuit failure has been detected. The possible failures for this alarm are loss of microprocessor clock, failure to reset internal microprocessor watchdog timer, disconnection of the battery pack, or an open or shorted cell in the battery pack.

No Set Alarm

With no feeding set installed, the pump will alarm and display the "NO SET" message when START/HOLD is pressed and the rate is not zero.

System Error Alarm

The pump will alarm and display "SYS ERR" when the pump detects rotor movement when the rotor is supposed to be stationary. A system error will also be generated if the rotor is significantly slowed or stopped during a pumping cycle.

2. maintenance (cont.)

Low Battery Alarm
The pump will alarm and display "LO BATT" when the battery voltage drops below a preset threshold. The alarm may be acknowledged by placing the pump on the charger base or by pressing the START/HOLD key twice. The pump will run for 15 minutes in the low battery state without being placed on the charger base before turning itself off. The pump will give a final 20-second long LO BATT alarm before disabling itself.

Flow Error Alarm
The pump will alarm and display "FLO ERR" when no drops have been detected within approximately two motor cycles (i.e., set is empty or flow is restricted).

Dose Delivered Alarm
The pump will alarm and display "DOSE DEL" when the pump has delivered the programmed dose; i.e., when the volume counter equals the dose setting. This alarm does not occur when the pump is in the intermittent feeding mode.

Hold Error Alarm
The pump will alarm and display "HLD ERR" when the pump is left in the HOLD state for 2.5 minutes. Any press of any key (except the ON key) restarts the 2.5 minute timer.

Alarm Test
The audible alarm and the pump set safety interlock may be tested by performing the following steps:

1. Turn the pump on and set any non-zero rate.
2. Remove the pump set from the pump (if loaded) and push the START/HOLD key.
3. The pump should generate the audible alarm and display "**no SEt.**"

2. maintenance (cont.)

recommended performance test

SERIAL NUMBER: _____ Date: _____

EQUIPMENT
CONTROL NO: _____ TECHNICIAN: _____

1. Exterior Cleaning/Inspection
   a. Power cord not damaged
   b. Rotor rollers turn freely _____
   c. Clean case, rotor, and drop sensor window (refer to Service Manual) _____
   d. Check rotor shaft for straightness _____

2. Touch Panel and Display
   a. "ON" button _____
   b. "OFF" button _____
   c. "▲" button _____
   d. "▼" button _____
   e. "START/HOLD" button _____
   f. "VOLUME" button _____
   g. "DOSE" button _____
   h. "INT" button _____
   i. "CLR" button _____

3. Visual Indicators
   a. AC/Quick charge light (on charger base) _____
   b. NO SET Alarm _____
   c. SYS ERR Alarm _____
   d. FLO ERR Alarm _____
   e. HLD ERR Alarm _____
   f. Intermittent Feeding Indicator (flashing LED on pump display) _____

4. Pump Motor Cycle Times (with feeding set in place)
   A. Fill a feeding set with water and connect it to the pump. Do not place the pump in the backpack/frame at this time.
   B. Turn the pump ON and set the delivery rate to 10 ml/hr.
   C. Using an oscilloscope or timer/counter, measure the time period from the beginning of one pumping cycle to the next. The beginning of a pumping cycle is defined by the rising edge of voltage being applied to the motor. Record the cycle time below and compare to the chart in the Service Manual.
   D. Repeat step C at a delivery rate of 400 ml/hr.
   E. Repeat steps C and D with the pump in the backpack/frame.
      a. In Backpack/Frame
         10 ml/hr _____ sec
         400 ml/hr _____ sec
      b. Not in Backpack/Frame
         10 ml/hr _____ sec
         400 ml/hr _____ sec

2. maintenance (cont.)

recommended performance test (cont.)

5. Battery Charge Monitoring

   ON the Charger Base

   a. The Internal Problem Alarm will be displayed when the battery voltage is greater than 4.98 VDC or less than 2.60 VDC. _____ VDC

   OFF the Charger Base

   b. The Low Battery Alarm will be displayed when the battery voltage drops below 3.40 VDC. _____ VDC

   c. The Low Battery Alarm will be displayed again when the battery voltage drops below 3.24 VDC, and then the pump will turn itself off. _____ VDC

6. Electrical Safety Tests

   a. Chassis to Ground Resistance (0.15 ohms or less) _____ ohms

   b. Leakage Current (less than 100 microamperes)

	ON	OFF
1. Normal	_____ μA	_____ μA
2. Open Ground	_____ μA	_____ μA
3. Open Ground Reverse Polarity	_____ μA	_____ μA

7. Operational Tests

   a. All units should be operated at 150 ml/hr for 5 minutes, with a feeding set in place.

   b. Operate pump for 16 minutes at 5 ml/hr.

COMMENTS: _____

NOTE: It is recommended that this test be conducted twice a year but no less than once a year.

2. maintenance (cont.)

charger base assembly

Please refer to the **charger base parts breakdown diagram** and **parts list** for assembly information when servicing the charger base.
User serviceable parts are those that have a CUSTOMER ORDER NUMBER listed in the appropriate **parts list**.
When assembling the charger base, DO NOT OVERTIGHTEN SCREWS.
The protective earth ground may be accessed from the exterior of the charger base via the case screw labelled as such in the **charger base parts breakdown diagram.**
Refer to the **charger base parts breakdown diagram** to see the proper routing of the power conductors through retaining slots in the charger base housing. The charger base is easily assembled if the power conductors are arranged in the retaining slots as shown, with the two halves of the charger base housing at a right angle with the bottom of the halves forming the vertex of the angle. The remaining length of the power conductors will then fold into the recessions formed by the housing wall and interior ribs as the housing halves are brought together by closing the angle.
Note that the power conductors must be connected to the proper terminal blocks. The chart below gives the proper connections.

TERMINAL BLOCK	CONDUCTOR	WIRE COLOR
TB1	LIVE	BROWN or BLACK
TB2	NEUTRAL	BLUE or WHITE
TB3	PROTECTIVE EARTH GROUND	GREEN and YELLOW STRIPE

ambulatory pump assembly

Please refer to the **ambulatory pump parts breakdown diagram** and **parts list** for assembly information when servicing the pump.
User serviceable parts are those that have a CUSTOMER ORDER NUMBER listed in the appropriate **parts list.**
When assembling the charger base, DO NOT OVERTIGHTEN SCREWS.

3. circuit description

charger base

AC to DC Conversion

Fuses F1 and F2 protect the user, charging base and pump in case of a short circuit. MOV1 and MOV2 clamp voltage spikes above their rated voltages, protecting internal circuits from large voltage spikes present on the AC input. Transformer TX1 converts the 115/230 VAC input to approximately 17 VAC, which is fed into diode bridge BR1. BR1 is a full wave rectifier that converts AC to pulsating DC, which is subsequently filtered by electrolytic capacitors C1 and C2. U1 is a switching voltage regulator that reduces an unregulated DC input into a regulated 7.3 VDC output. Further filtering is done with C3.

Supply Voltage Output

U2 further regulates the output of U1 to 5 VDC; this output is then filtered by C5 and protected by diode D2. The 5 VDC is terminated at pin 2 of connector J1A.

Charge Current Output

Current regulator U3 supplies a constant 85 mA to a load connected to pin 1 of connector J1A. This is used by the pump for trickle charging the internal NiCd batteries. The output of U3 is filtered by C6 and protected by D3.

Current regulator U4 supplies a constant 255 mA to a load connected to pin 1 of connector J1A. This output only occurs when FET Q1 is turned on. The output of U4 is filtered by C7 and protected by D4. The combined outputs of U3 and U4 are used to quick charge the internal NiCd batteries of the pump with a combined current of 340 mA.

Quick Charge Control

The pump generates a TTL-level signal received by the charger base at pin 4 of J1A. If no pump is connected to the charge base or if a pump is connected and the control signal is high, transistor Q3 is turned off, and the signal at U5B pin 5 is low. This low causes the output of this gate at pin 4 to go high, turning on FET Q2. This in turn allows drain to source conduction, allowing current to flow through LD1 and light to be emitted. This state will last as long as the charger base is powered and no pump is connected or the control signal from the pump is high.

If the control signal from the pump goes low, transistor Q3 is turned on, resulting in a high signal at U5B pin 5. Because U5B pin 6 will normally float to a high level when the charger base is powered, the combination of inputs to U5B will cause the gate to output a low signal. The low output turns off FET Q2 and blocks current flow through LD1, extinguishing the light output. The low output of U5B also discharges capacitor C8 through R8. After about 3 seconds, the signal at U5B pin 6 will be low, and the output of U5B will then go high. This again turns on Q2 and allows current flow through LD1. This cycle repeats itself as long as the charger base is powered and the control signal from the pump is low. The flashing of LD1 is the visual indication that quick charging is occurring.

U5A simply inverts the output of Q3. When Q3 is turned on by a low input from the pump, the input of U5A (pins 1 and 2) is high; this high results in the output of U5A (pin 3) going low. This turns on FET Q1, allowing current to flow from the output of regulator U1 to quick charge current regulator U4. U4 is then able to supply the current required to quick charge the pump batteries.

3. circuit description (cont.)

ambulatory pump

Microprocessor

Microprocessor U4 controls all operations of the pump and charging base. This is a Motorola MC68HC705C8 8-bit processor with 32 I/O lines available, divided into four groups of eight. Port A drives the LED display segments; Port B drives the LED display digit driver FETs and the keypad rows, and also reads the keypad columns and SW1 outputs. Ports C and D are used for miscellaneous non-bussed I/O. The processor is driven by a 4 MHz crystal oscillator that clocks the internal circuit at 2 MHz, resulting in a 1 μs minimum instruction execution time. The processor (in the configuration used here) has approximately 8 Kbytes of ROM and 144 bytes of RAM internally.

Power Supply

The pump can receive power from its internal NiCd batteries, or from the charger base. The pump contains three sub-C NiCd cells with a capacity of 1800 mAh. The battery pack connects to the pump circuit board via connector J6. The pump may also operate from the 5 VDC output of the charging base. The charging currents, 5 VDC, and battery are prevented from backdriving each other by diodes D1, D10, and D16. Power from the acceptable sources is fed to switching voltage booster U2. Voltage levels are boosted here because the input to U2 is unregulated and sometimes significantly less than 5 VDC. The output of U2 in turn drives regulator U7 which produces a regulated 5 VDC. The output of U2 is also used to drive the pump motor connected to J2. The output of U7 drives the remaining pump circuit not driven by U2, U13, or U6. The 5 VDC output of U7 is also fed to FET Q7 to create a switched source of power.

U13 regulates the output of U7 down to 4 VDC. This voltage feeds voltage inverter U6; outputs of U7 and U6 power the drop detection circuit.

Power-On Circuit

The pump circuit may be activated in two ways. The first is by pressing the ON key. Activating this normally open switch creates a negative going pulse (dropping to ground from 5 VDC) that is connected to the IRQ line of the microprocessor and to U9 pin 2. If the microprocessor is already powered when this occurs, an interrupt is generated and the processor turns on the rest of the pump circuit if not already turned on.

U9 and Q4 and the resistors and capacitors connected to them form a latch that controls FET Q18. Q18 lies in the main ground path, and is used to completely remove power from all pump circuits except for the latch, which draws negligible power because U9 is a CMOS IC. A negative going pulse from the ON key will turn on the latch circuit and Q18 if not already turned on. If the latch and Q18 turn on, power will be generated by the regulators and a pulse will be generated to the RESET input of the microprocessor, turning it on. The microprocessor will then turn on the rest of the pump circuit.

The microprocessor also monitors I/O line PC1. PC1 will only be low if the ON key has been pressed, because constant current regulator Q10 keeps C45 charged even when the latch is disabled. If the pump is connected to an active charger base while the latch is disabled, a RESET pulse will be generated as above, and the microprocessor will turn on. The microprocessor will not see a low on PC1 however, so the microprocessor will turn on and only activate timing processes in the software. The purpose of this arrangement is to enable the microprocessor to start quick charging the

3. circuit description (cont.)

pump battery as soon as the pump is plugged into the charger base, even if the latch was not activated and the ON switch was not pushed.
Removal of power to the microprocessor and the rest of the pump circuits is accomplished by asserting port PC0. This turns off the latch and FET Q18, killing power to all circuits except for Q10 and U9.

Reset Circuit

The microprocessor may receive a low input on the RESET line for three reasons. The first, as seen earlier, is the activation of the latch circuit. Power applied to the pump circuit will result in a pulse generated by R12 and C11.
U12 is a watchdog timer and power monitor. The microprocessor generates a negative going pulse every 250 milliseconds. This pulse train resets a timer in U12. If this timer is not constantly reset, U12 will generate a pulse at its output which will reset the microprocessor. U12 also monitors its supply voltage. If its supply drops below approximately 4.5 VDC, U12 will generate a reset pulse to the microprocessor. Diode D9 and capacitor C43 somewhat isolate U12 power from the 5 VDC buss.

Battery Monitoring

Resistors R5 and R6 divide the battery voltage by 2; this voltage is then converted by the A/D converter into an eight bit representation of one half of the battery voltage. The eight bits are read serially by the microprocessor using ports PC7, PC6, and PD0 every 500 milliseconds (or every other resetting of the watchdog timer U12).
Software in the microprocessor determines when the battery needs to be quick charged. If quick charging is necessary, port PC5 signals the charger base (isolated by optoisolator U11) to deliver quick charge current.

Touch Panel

The touch panel is connected to the pump circuit board with connector J5. The panel is arranged in a 3x3 matrix, with the rows being driven by microprocessor ports PB1, PB2 and PB3. Microprocessor ports PB4, PB5 and PB6 read the column information. Software in the microprocessor decodes the row/column information and generates a unique byte to represent each switch in the matrix. It should be noted that the ON key is independent and not part of the matrix. Microprocessor ports PB4, PB5 and PB6 also read switch SW1 when this switch is driven by PB0. Switch SW1 is used to select the language for messages displayed on the LEDs. Diodes D4A, D4B, D18A, D18B, D12, D13A and D13B isolate parallel lines from each other. Switch debouncing is accomplished in software.

LED Display

LEDs DP4, DP3, DP2 and DP1 are used to display feeding profile information and error messages. Microprocessor ports PB3, PB2, PB1 and PB0 drive FETs Q16, Q15, Q14 and Q13 respectively. The FETs allow a greater current flow to the LED segment common connections than possible with the microprocessor I/O ports. Segment information is driven by port A of the microprocessor. These I/O lines are capable of sinking enough current to drive the display segments.

3. circuit description (cont.)

Drop Detector

The pump monitors fluid flow by optically detecting drops falling through the drip chamber. Two IR LEDs are driven by constant current source Q11 and connected to the circuit board through J3 pins 3 and 4. A photodiode is likewise connected to J3 pins 1 and 2. The photodiode is protected from the effects of visible light by a polysulfone filter integral to the drip chamber yoke. The signal from the photodiode is amplified, differentiated, passed through a sixth order low-pass filter, amplified, chopped and finally squared for presentation to the microprocessor. The signal from the photodiode is processed by U5 and the surrounding passive networks. The output of this processing is then buffered by U1 and then input to the microprocessor.

Motor

The pump motor is connected to the pump circuit board by connector J2. Power to the motor is controlled by FET Q6. The motor is also braked by FET Q5. Q6 and Q5 are never turned on simultaneously, and are time delayed so that they never transition simultaneously. The microprocessor controls the motor from port TCMP. This signal is buffered by U1 and the surrounding RC networks. The RC networks cause the dynamic brake Q5 to be released before applying power through Q6; conversely, power to the motor through Q6 is always removed before applying dynamic brake Q5.

Fail-Safe

In the unlikely event that the motor should continuously run and not turn off, a fail-safe circuit will crowbar the power supply to ground and blow fuse F1. Constant current regulator Q3 gets its power from the motor circuit; as the motor runs, Q3 charges capacitor C3. When the voltage at the anode of Q2 exceeds the voltage on the gate (set by divider R1 and R2), Q2 turns on, raising the voltage at the gate of Q1. When the gate of Q1 rises above ground, Q1 turns on and allows current from the battery to pass directly through it to ground, blowing F1. The fail-safe circuit takes approximately 13 seconds to trip.

Rotor Detection

The microprocessor monitors the rotation of the DC motor by counting pulses generated by the interaction of 3 magnets on the pump rotor with Hall-effect switch S1. The microprocessor receives the signal from S1 on port PD5. Debouncing of this switch occurs in software.

Frame Detection

The microprocessor detects the presence of the backpack frame on port PD3, using Hall-effect switch S2. A magnet in the frame will close S2 when the pump is fully inserted into its pocket in the frame.

Pump Set Detection

The microprocessor detects the presence of a pump set on port PD7, using a Hall-effect switch connected to the pump circuit board through J1 pins 4, 5 and 6. The SIPS magnet on the pump set activates the switch when the pump set is properly inserted into the loading arm and the loading arm is then closed.

Audio Alarm

Audible alarms are generated using a piezoelectric element connected to the pump circuit board through connector J4. The TTL-level oscillation generated by the microprocessor at port PC3 is boosted by U14 and U15 to a 20 VDC level.

3. circuit description (cont.)

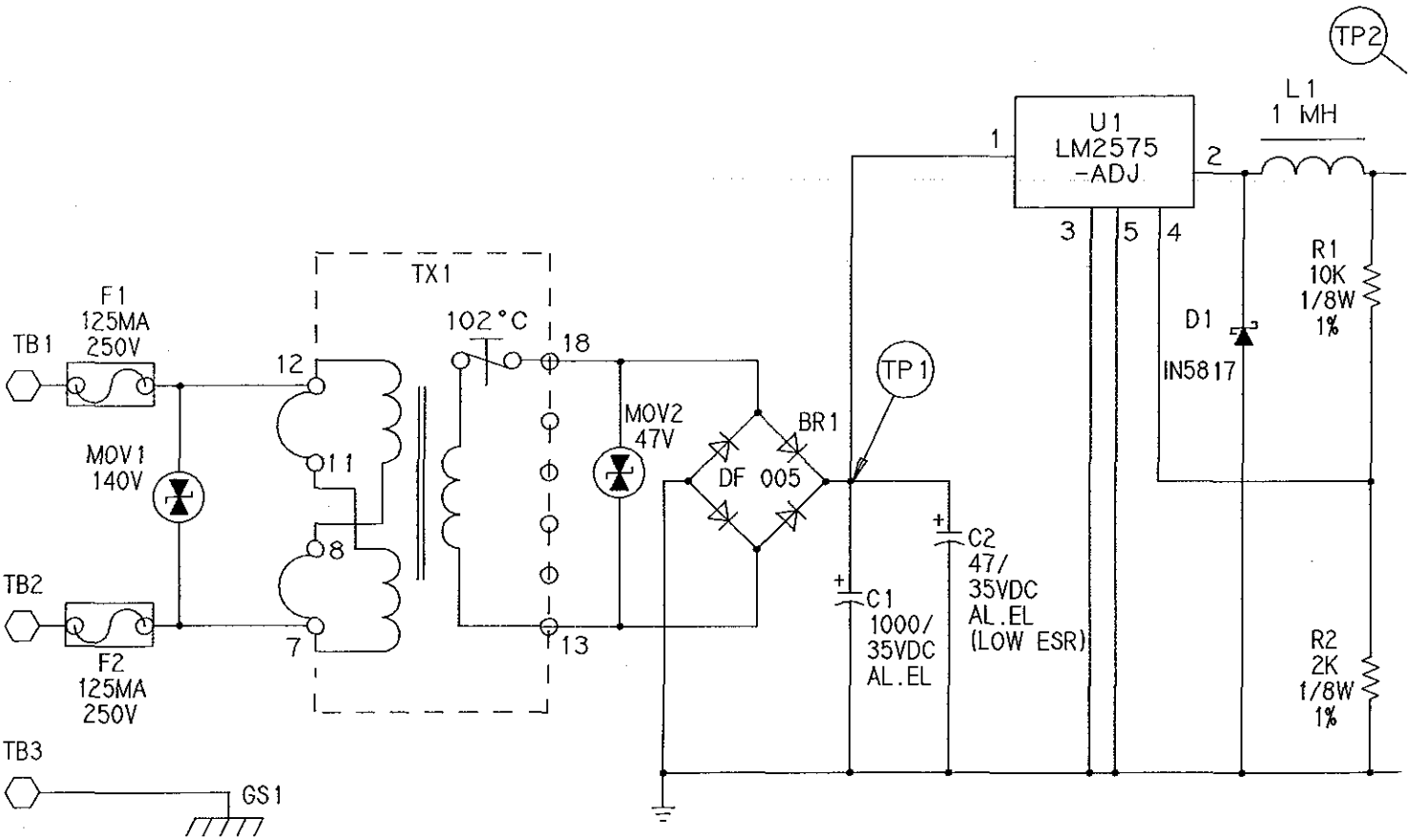
language selection

Selection of the language used for the pump display is determined by the position of the rotary switch mounted on the pump circuit board. This rotary switch may be rotated by placing the tip of a small flat-bladed screwdriver into the switch access hole inside the battery compartment. This access hole is located next to the right-hand screw hole inside the battery compartment. The chart below shows the switch settings by country and the language display text. The language display text may be accessed by pressing the CLR key while simultaneously turning the pump on. Note that the switch setting numbers increase as the switch is rotated in a clockwise direction. Switch position 0 is at the top of the switch.

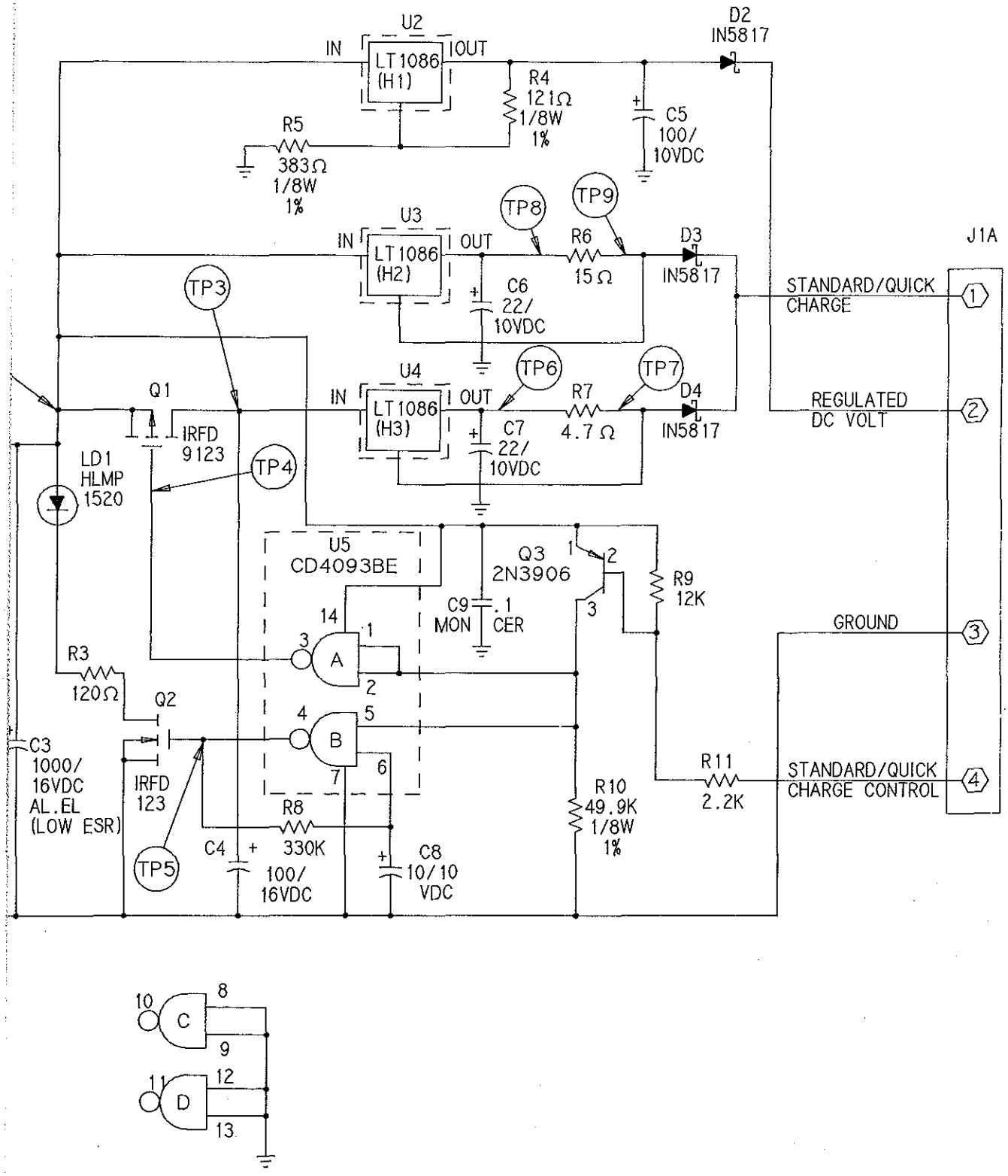
SWITCH POSITION #	LANGUAGE	DISPLAY TEXT
0	English or Japanese (U.S./Canada)	CUS
1	English (UK/Australia)	EnA
2	German	GEr
3	Dutch	nEth
4	French	FrA
5	Italian	itA
6	Swedish	Sdn
7	Spanish	ESP
8	English or Japanese (U.S./Canada)	CUS
9	English (UK/Australia)	EnA

4. printed circuit boards

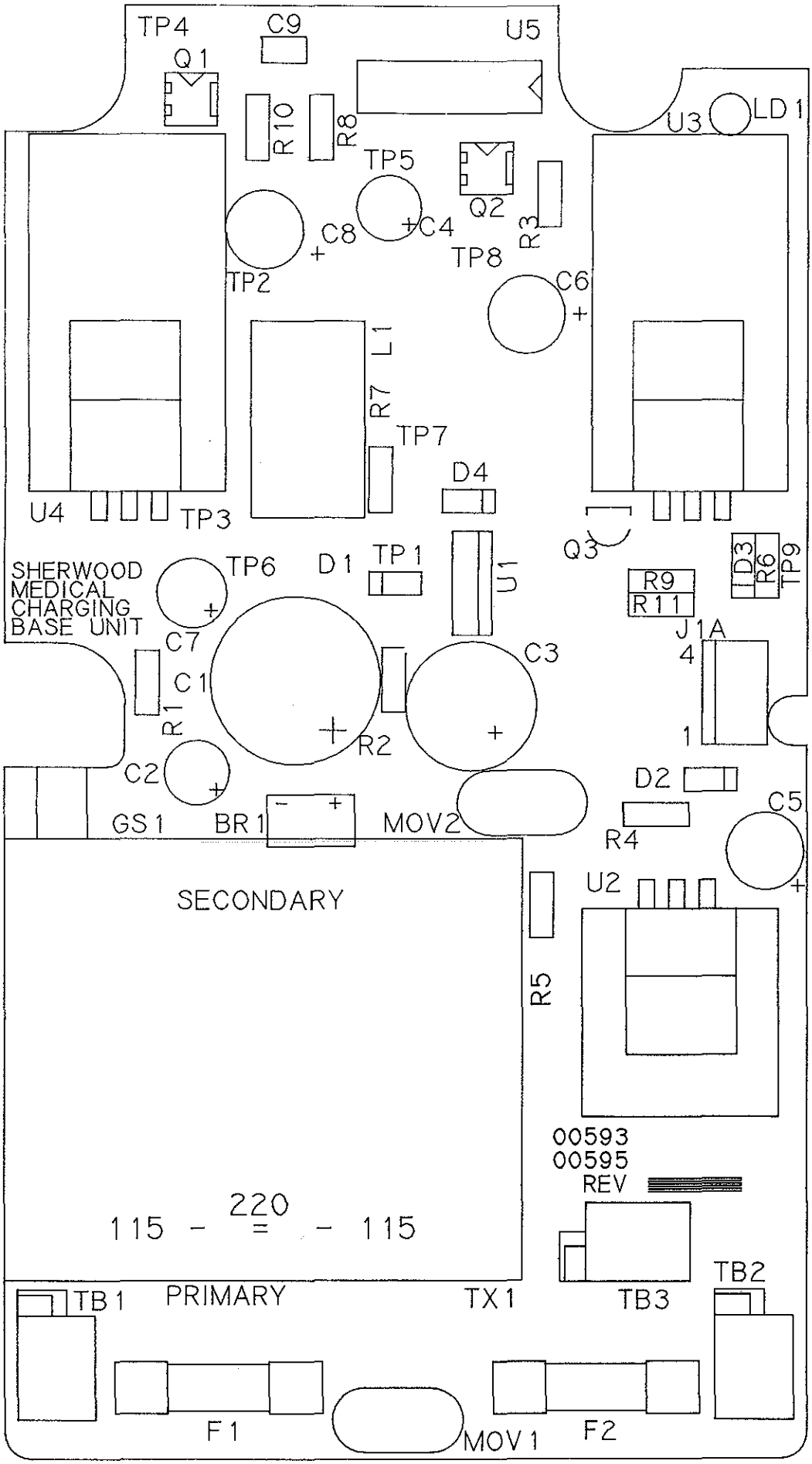
charger base schematic diagram



3. RESISTORS 1/4W , 5% CARBON FILM UNLESS OTHERWISE SPECIFIED.
2. CAPACITORS ARE TANTALUM UNLESS OTHERWISE SPECIFIED (VALUES IN MICROFARAD).
1. ⏚ CHASIS GROUND. ⏚ SYSTEM GROUND.


U2
IN
LT1086
(H1)
OUT
R4
121Ω
1/8W
1%
D2
IN5817
C5
100/
10VDC
R5
383Ω
1/8W
1%
U3
IN
LT1086
(H2)
OUT
TP8
TP9
R6
15Ω
D3
IN5817
J1A
TP3
C6
22/
10VDC
STANDARD/QUICK
CHARGE
1
U4
IN
LT1086
(H3)
OUT
TP6
TP7
R7
4.7Ω
D4
IN5817
Q1
IRFD
9123
C7
22/
10VDC
REGULATED
DC VOLT
2
LD1
HLMP
1520
TP4
U5
CD4093BE
Q3
2N3906
R9
12K
C9
.1
MON
CER
GROUND
3
R3
120Ω
Q2
A
B
C3
1000/
16VDC
AL.EL
(LOW ESR)
IRFD
123
R11
2.2K
STANDARD/QUICK
CHARGE CONTROL
4
R10
49.9K
1/8W
1%
R8
330K
C4
100/
16VDC
C8
10/10
VDC
TP5
C
D

charger base PCB assembly diagram

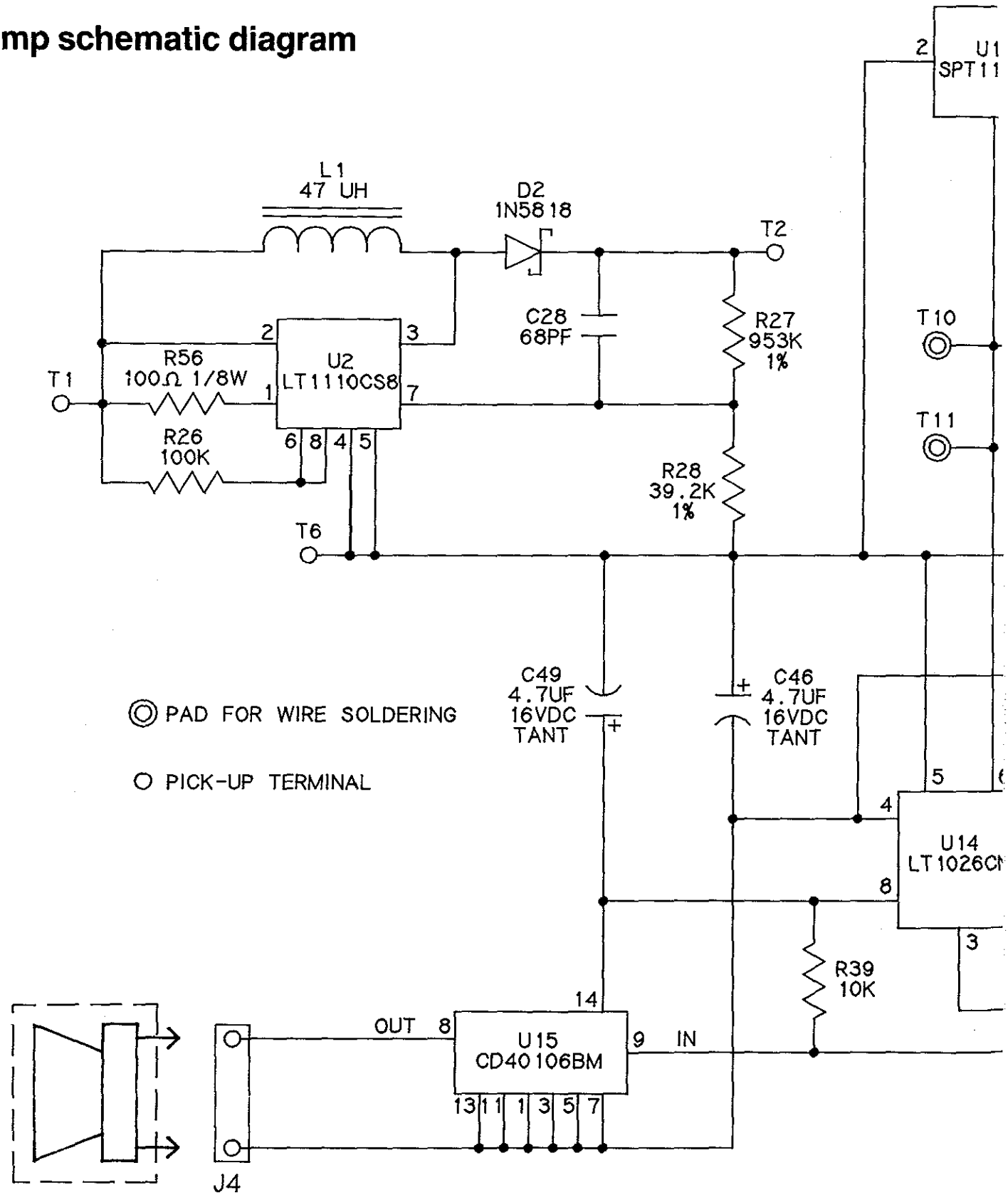


parts list

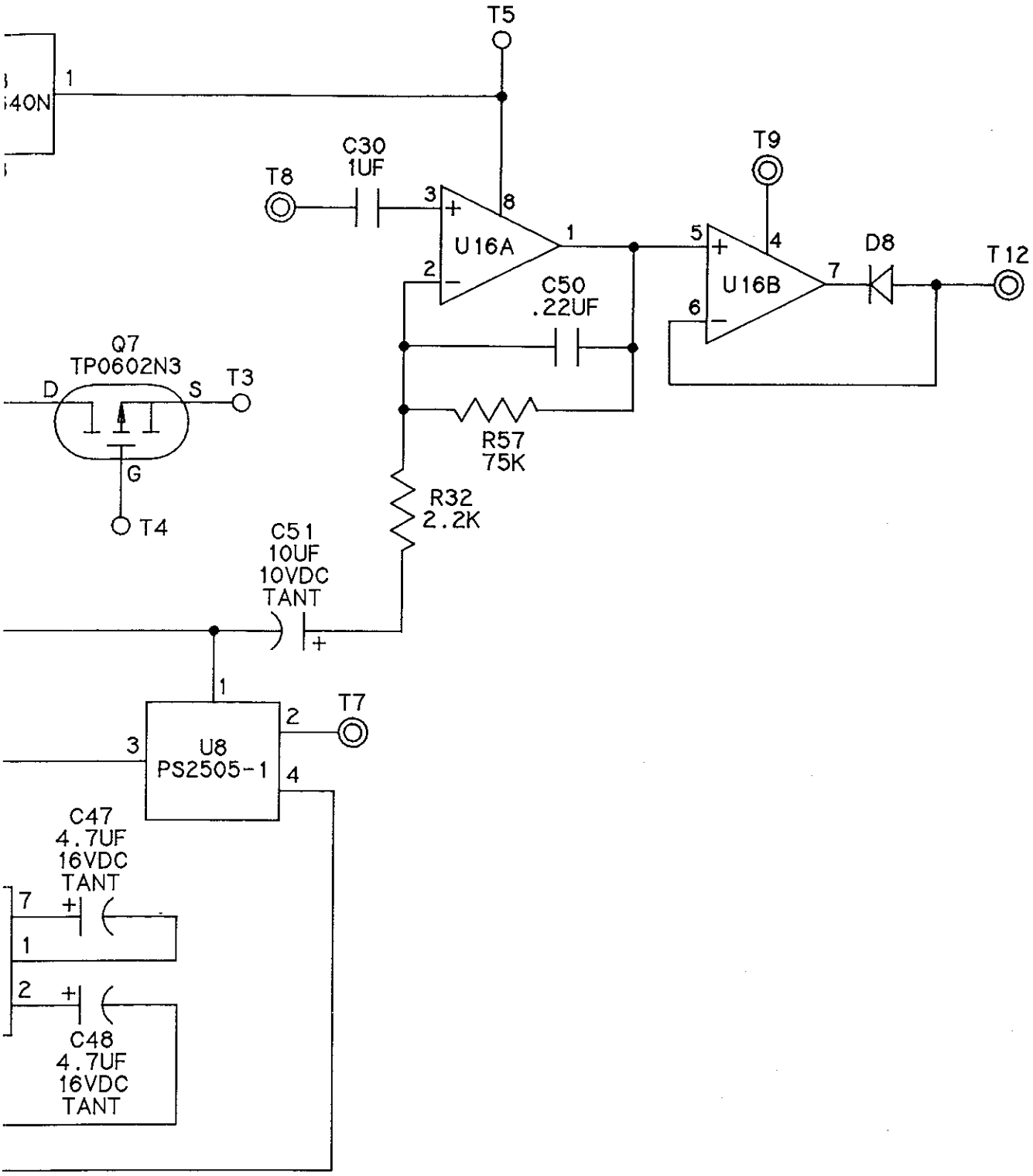
REORDER NO.	DESCRIPTION	QTY	DESIGNATION
7774-101682	FUSE CLIP	4	USED WITH F1, F2
7774-101955	1/8 AMP FAST ACTING FUSE	2	F1, F2
7774-102003	1MH INDUCTOR	1	L1
7774-102029	HEAT SINK	2	USED WITH U3, U4
7774-102060	HEAT SINK	1	USED WITH U2
7774-102078	TRANSFORMER 115/230 VAC	1	TX1
7774-200427	QUAD NAND 4093	1	U5
7774-202563	1.5A LOW DROPOUT POS. REGULATOR	3	U2, U3, U4
7774-202571	STEP-DOWN VOLTAGE REGULATOR	1	U1
7774-300441	MOSFET TRANSISTOR IRFD9123	1	Q1
7774-300466	PNP TRANSISTOR 2N3906	1	Q3
7774-300730	SCHOTTKY DIODE 1N5817	4	D1, D2, D3, D4
7774-030089	HEXFET TRANSISTOR 123	1	Q2
7774-030865	140 VOLT VARISTOR	1	MOV1
7774-030006	BRIDGE RECTIFIER	1	BR1
7774-030014	47 VOLT VARISTOR	1	MOV2
7774-400753	49.9K OHMS 1/8W 1% RESISTOR	1	R10
7774-040104	120 OHMS 1/4W 5% RESISTOR	1	R3
7774-401611	12K OHMS 1/4W 5% RESISTOR	1	R9
7774-402684	2K OHMS 1/8W 1% RESISTOR	1	R2
7774-402866	2.2K OHMS 1/4W 5% RESISTOR	1	R11
7774-404144	10K OHMS 1/8W 1% RESISTOR	1	R1
7774-040427	330 OHMS 1/4W 5% RESISTOR	1	R8
7774-406248	383 OHMS 1/8W 1% RESISTOR	1	R5
7774-406586	121 OHMS 1/8W 1% RESISTOR	1	R4
7774-406594	15 OHMS 1/4W 5% RESISTOR	1	R6
7774-406602	4.7 OHMS 1/4W 5% RESISTOR	1	R7
7774-500818	10 UF SOLID TANTALUM CAPACITOR	1	C8
7774-050186	100 UF SOLID TANTALUM CAPACITOR	1	C5
7774-501717	47 UF AL. ELECTROLYTIC CAPACITOR	1	C2
7774-501733	100 UF AL. ELCTROLYTIC CAPACITOR	1	C4
7774-501741	22 UF SOLID TANTALUM CAPACITOR	2	C6, C7
7774-501766	1000 UF ELECTROLYTIC CAPACITOR	1	C1
7774-501899	0.1 UF CERAMIC CAPACITOR	1	C9
7774-600618	GREEN LED T-1 UNTINTED	1	LD1
7774-802669	4 PIN FRICTION LOCK HEADER	1	J1A
7774-802776	TERMINAL BLOCK	3	TB1, TB2, TB3
7774-400613	NO. 4-40 KEP NUT	3	USED WITH U2, U3, U4
7774-302785	NO. 4-40 x 9/16 PAN HEAD. X REC.	3	USED WITH U2, U3, U4
7774-310457	CHARGER GROUND STRAP	1	GS1
NOT AVAILABLE	THERMAL JOINT COMPOUND	AR	USED WITH U2, U3, U4
7774-802974	TEST PIN	1	TP1
7774-501725	1000 UF AL. ELECTROLYTIC CAPACITOR	1	C3

4. printed circuit boards (cont.)

pump schematic diagram

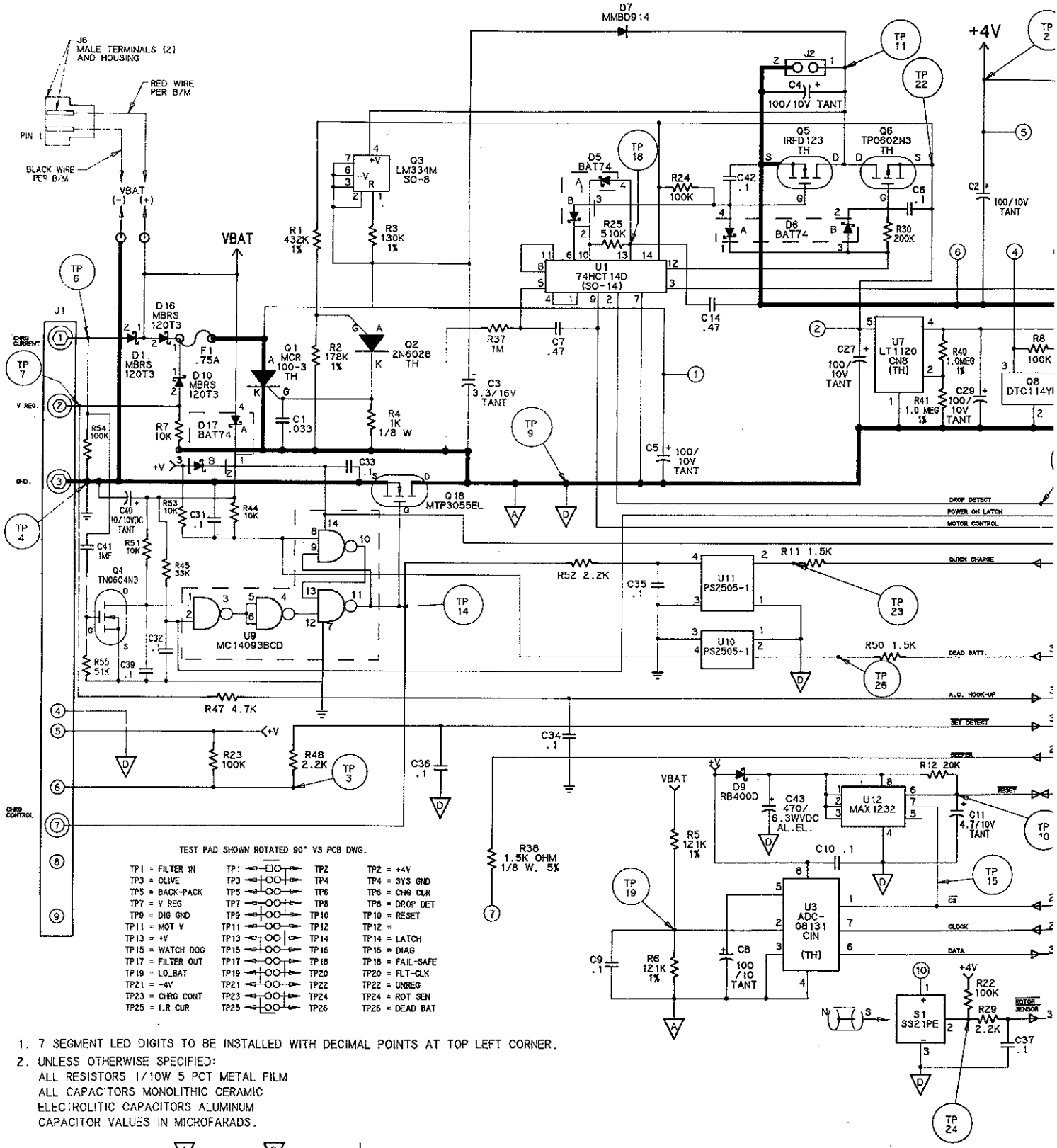


MODULAR SCHEMATIC

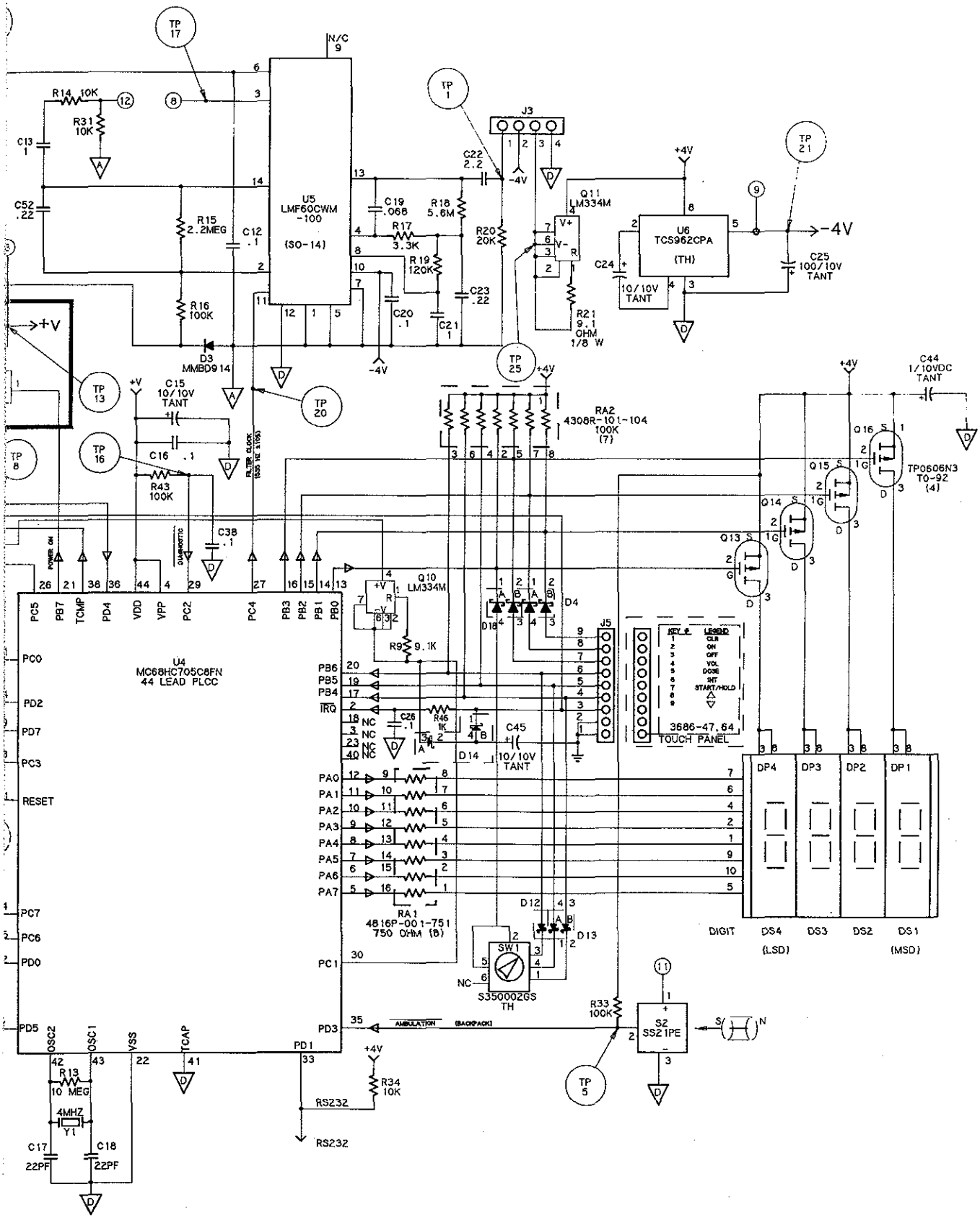

T5
1
40N
C30
1UF
T8
3
8
U16A
1
2
C50
.22UF
T9
5
4
U16B
7
6
D8
T12
Q7
TP0602N3
D
S
T3
G
T4
R57
75K
R32
2.2K
C51
10UF
10VDC
TANT
+
1
T7
2
3
U8
PS2505-1
4
C47
4.7UF
16VDC
TANT
7
+
1
2
+
C48
4.7UF
16VDC
TANT

4. printed circuit boards (cont.)

pump schematic diagram

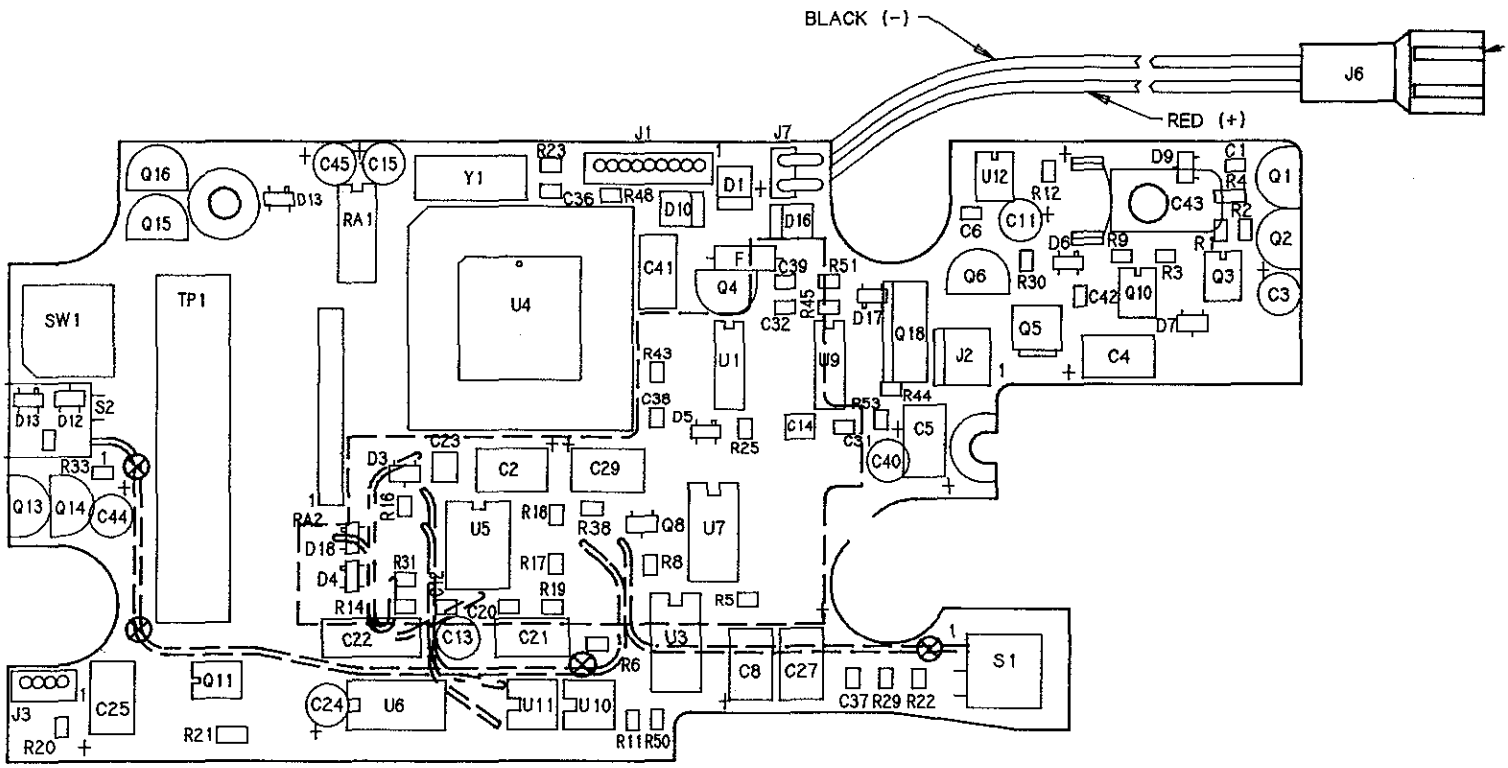


1. 7 SEGMENT LED DIGITS TO BE INSTALLED WITH DECIMAL POINTS AT TOP LEFT CORNER.
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS 1/10W 5 PCT METAL FILM
   ALL CAPACITORS MONOLITHIC CERAMIC
   ELECTROLITIC CAPACITORS ALUMINUM
   CAPACITOR VALUES IN MICROFARADS.
3. GROUND SYMBOLS: ANALOG; DIGITAL; SWITCHED SYSTEM GROUND.
4. REQUIRES SHORTEST AND THICKEST POSSIBLE TRACE.

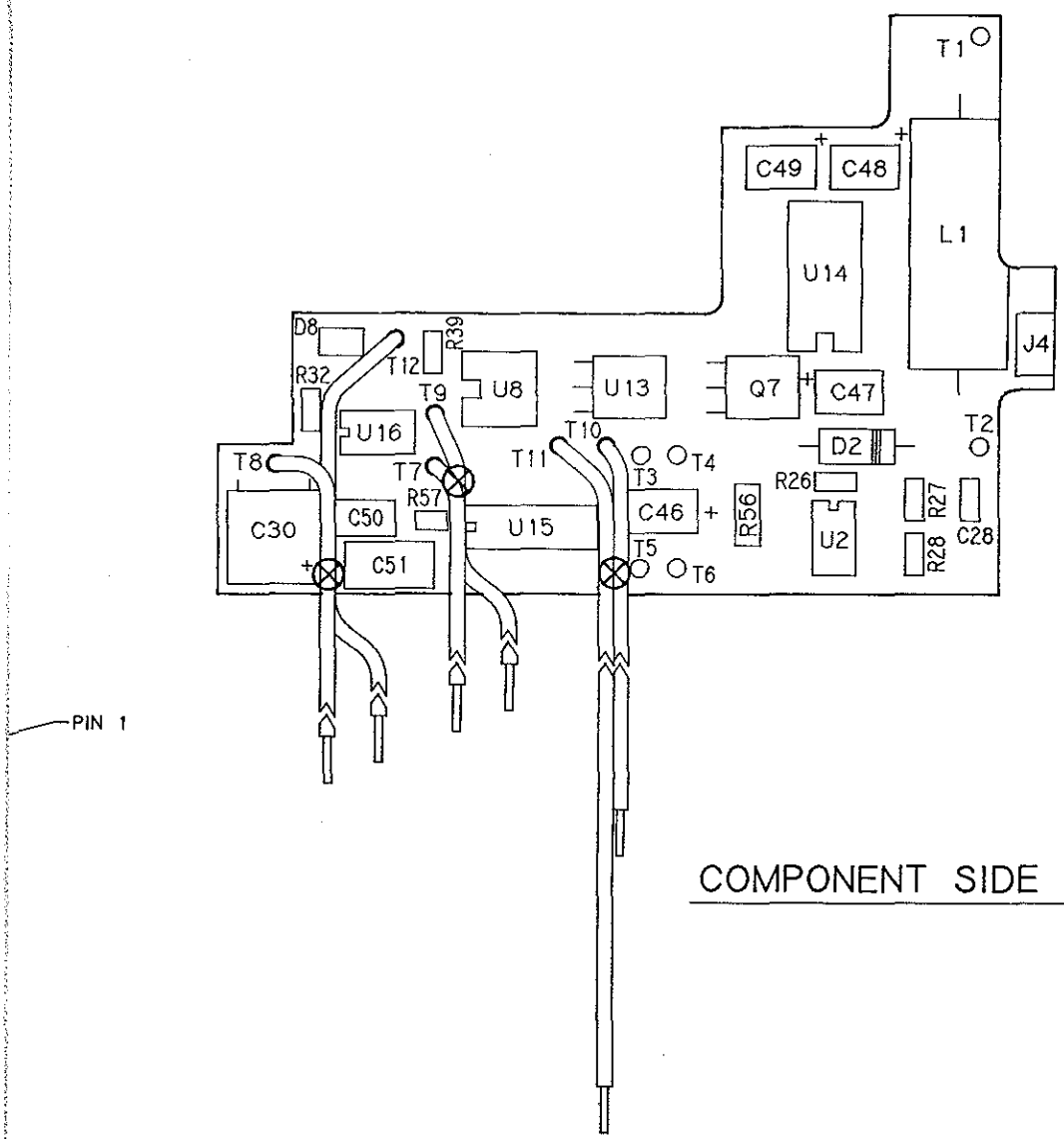

U4
MC68HC705C8FN
44 LEAD PLCC
U5
LMF60CWM
-100
(SO-14)
U6
TCS962CPA
(TH)
Q10
LM334M
Q11
LM334M
RA1
4816P-001-751
750 OHM (8)
RA2
4308R-101-104
100K
(7)
J3
J5
SW1
S350002GS
TH
S2
SS21PE
3686-47.64
TOUCH PANEL
DP4
DP3
DP2
DP1
DIGIT
DS4
(LSD)
DS3
DS2
DS1
(MSD)
TP0606N3
TO-92
(4)
4MHZ
Y1
RS232
AMBULATION
(BACKPACK)
TP 1
TP 5
TP 8
TP 13
TP 16
TP 17
TP 20
TP 21
TP 25
R14 10K
R31 10K
R15 2.2MEG
R16 100K
R17 3.3K
R18 5.6M
R19 120K
R20 20K
R21 9.1 OHM 1/8 W
R33 100K
R34 10K
R43 100K
R9 9.1K
R13 10 MEG
C12 .1
C13 1
C15 10/10V TANT
C16 .1
C17 22PF
C18 22PF
C19 .068
C20 .1
C21 1
C22 2.2
C23 .22
C24 10/10V TANT
C25 100/10V TANT
C26 .1
C38 .1
C44 1/10VDC TANT
C45 10/10V TANT
D3 MMBD914
D4
D12
D13
D14
D18
Q13
Q14
Q15
Q16
+4V
-4V
+V
N/C

4. printed circuit boards (cont.)

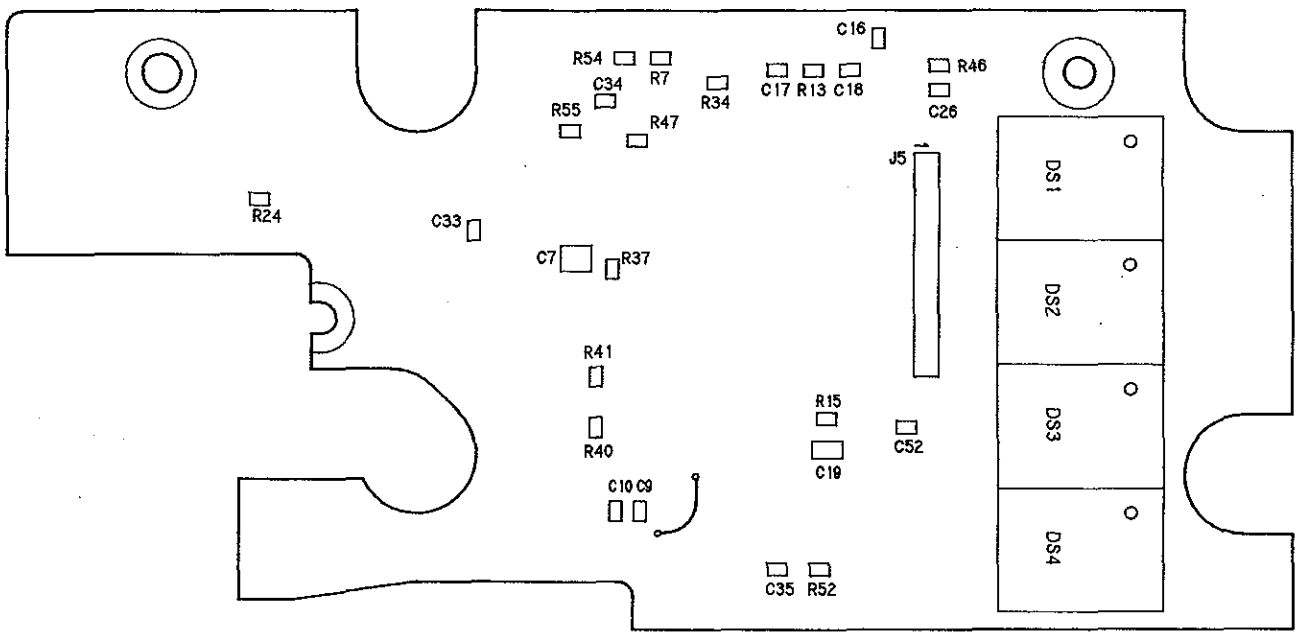
pump PCB assembly diagram



COMPONENT SIDE



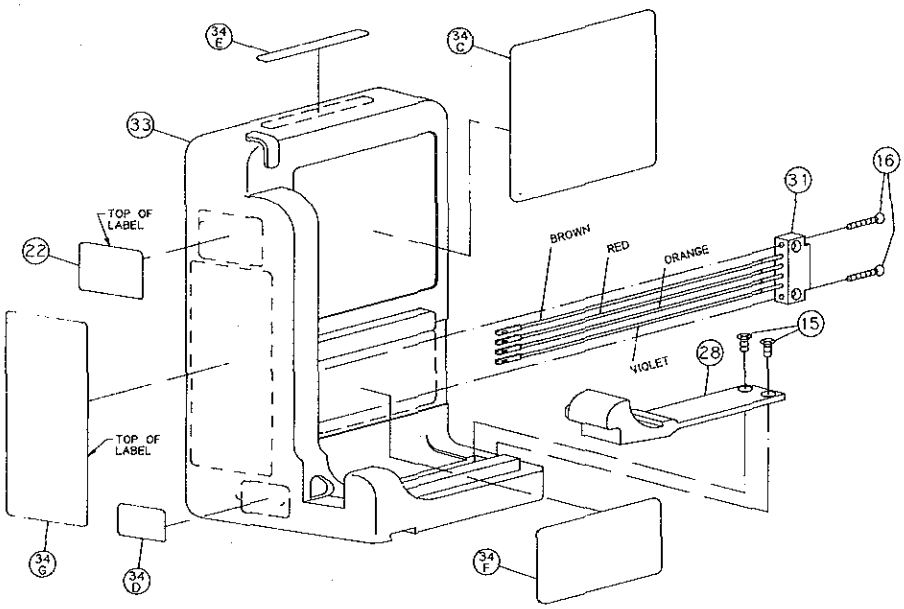
COMPONENT SIDE DETAIL

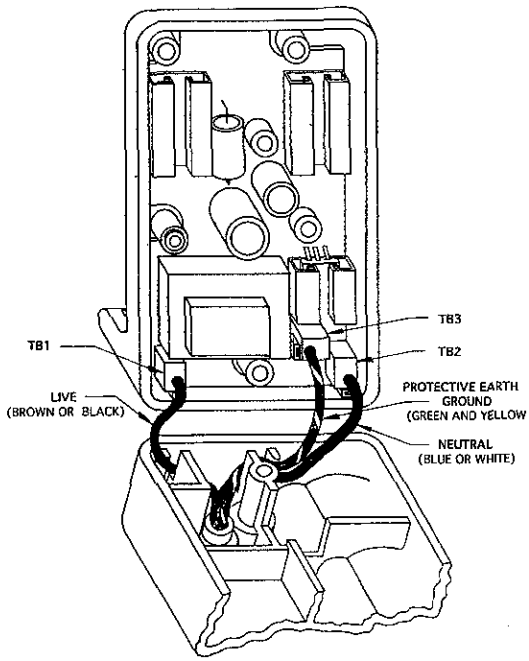


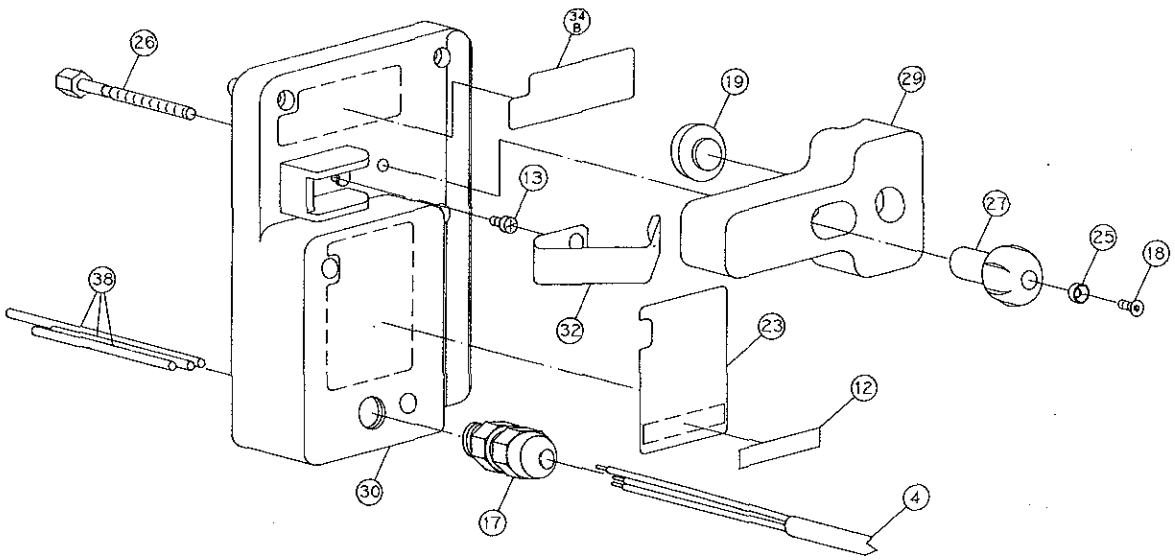
SOLDER SIDE

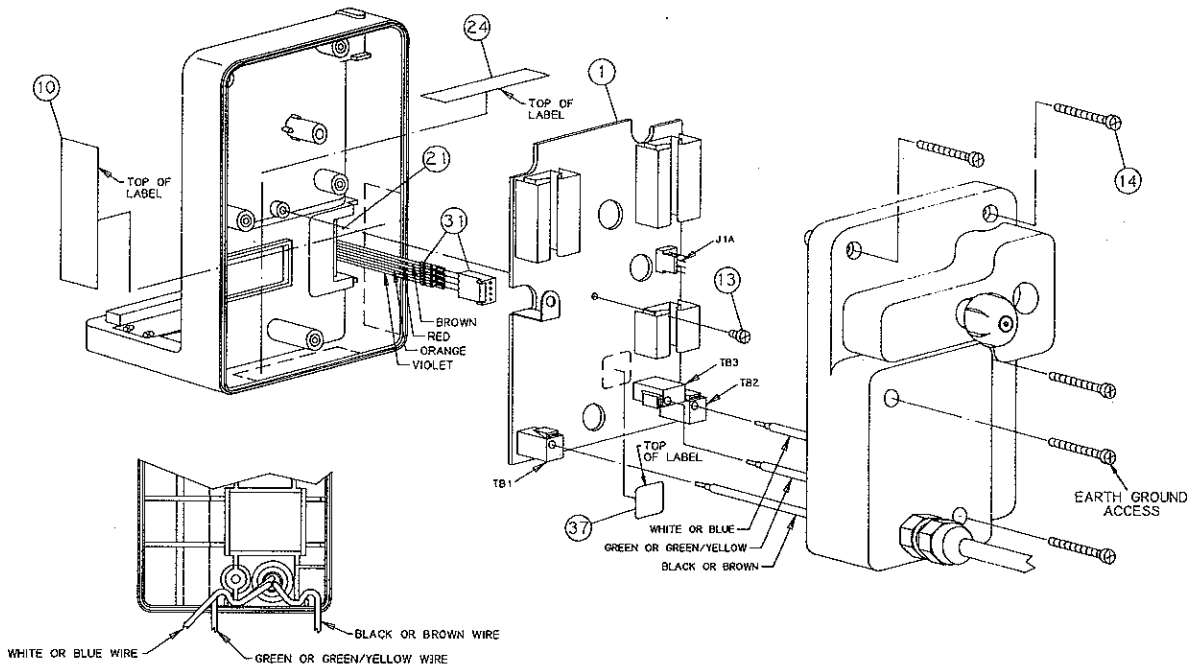
5. final assembly

charger base parts breakdown diagram

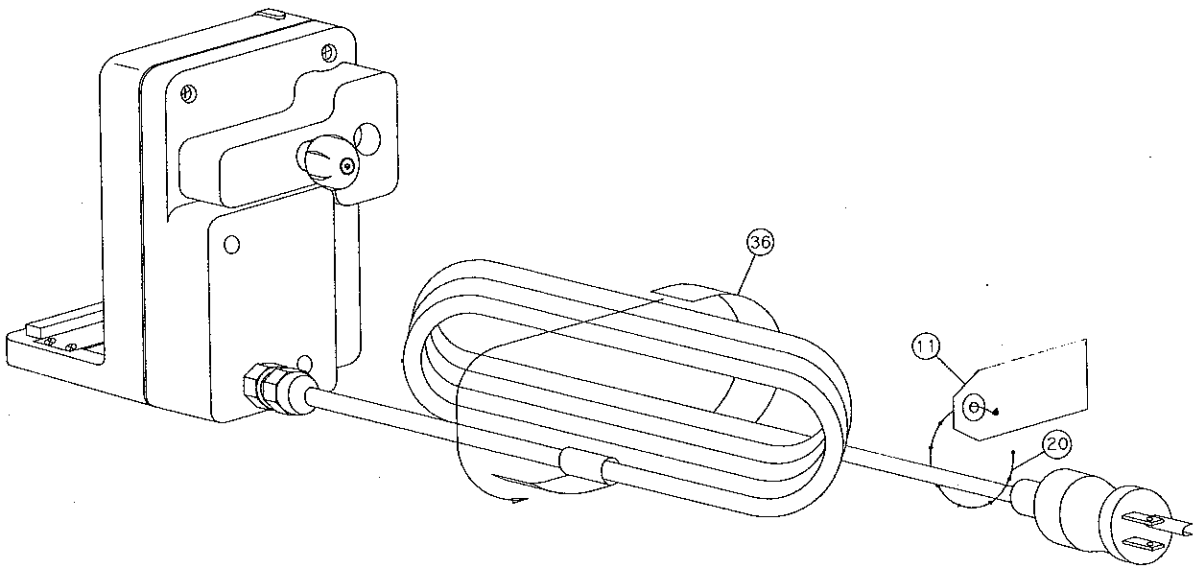






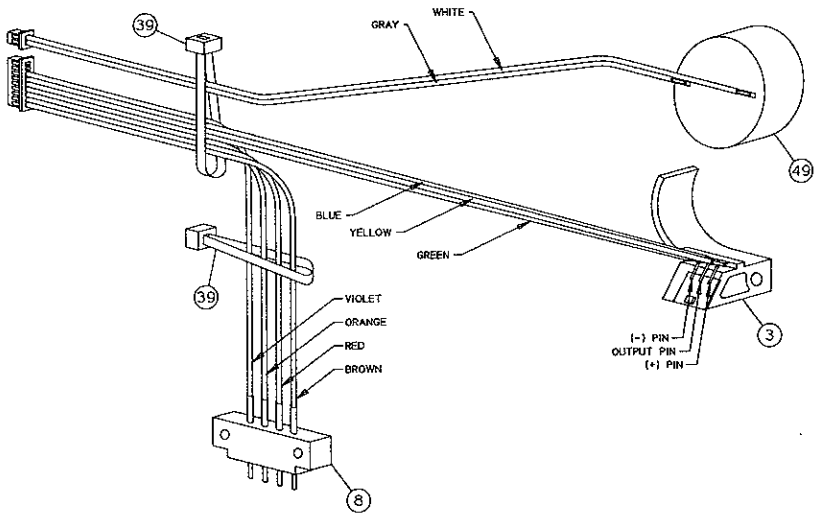


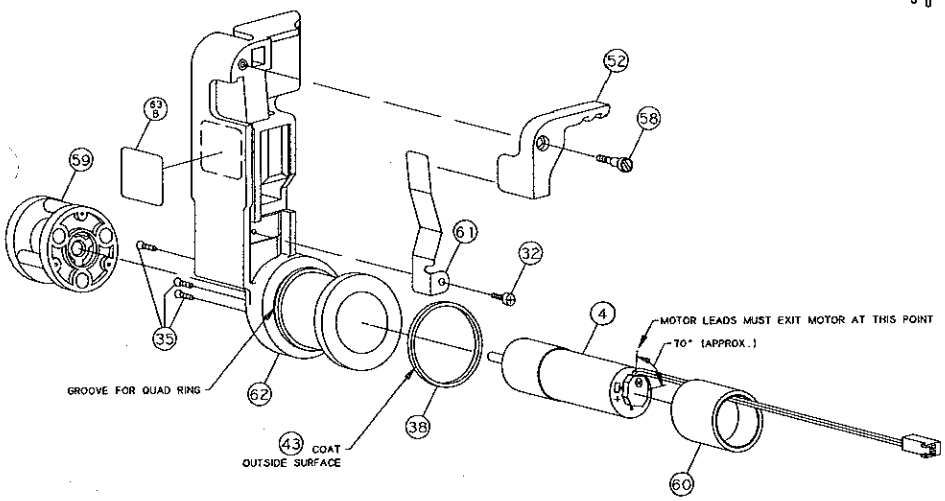
WIRE ROUTING DETAIL

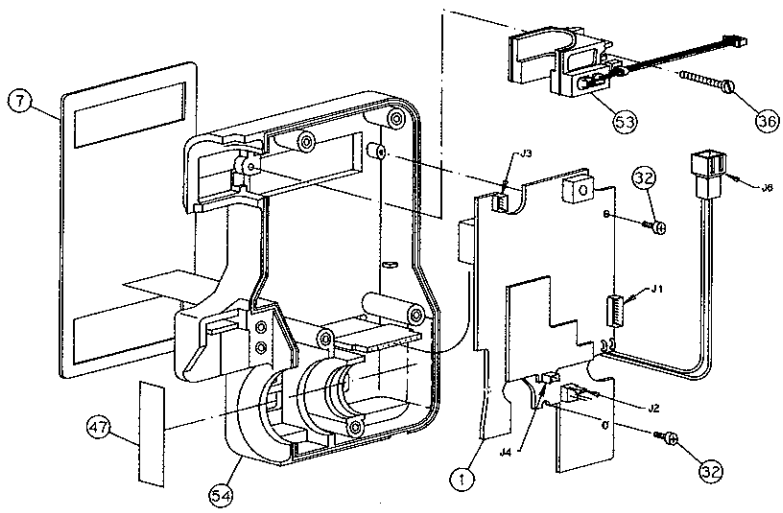


5. final assembly (cont.)

pump parts breakdown diagram





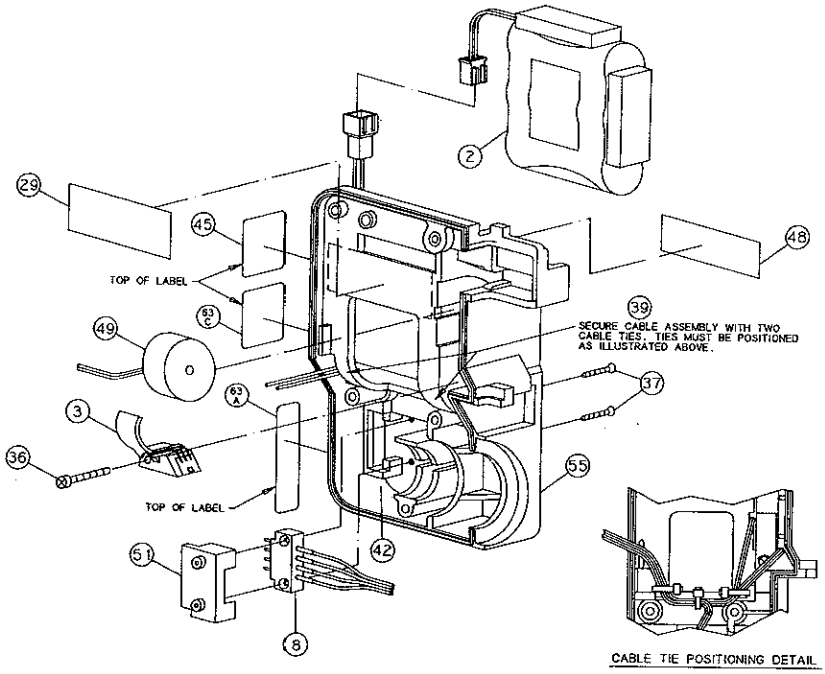


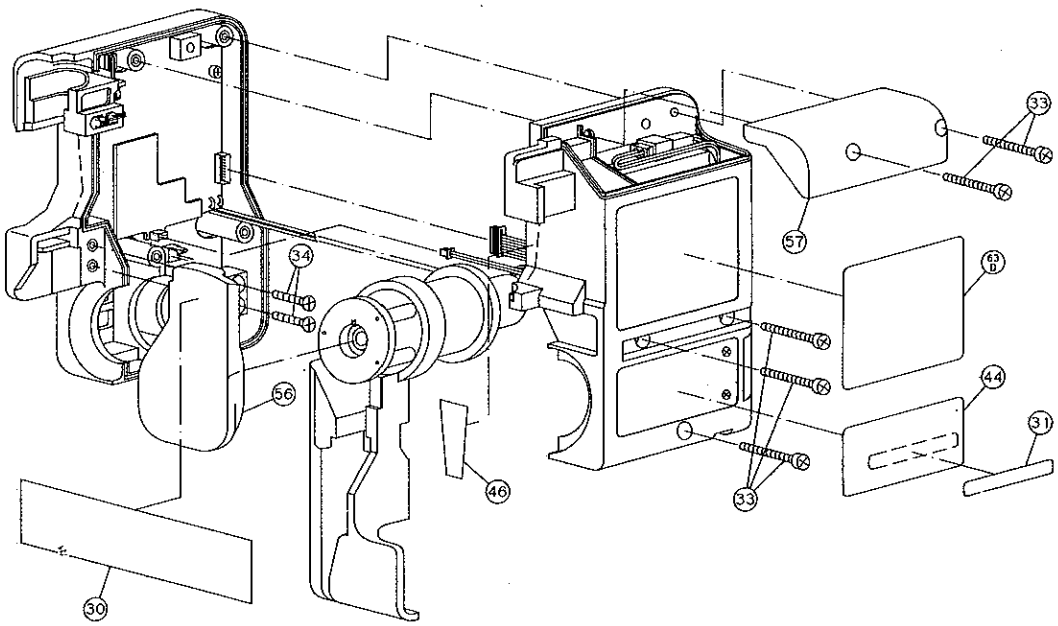
5. final assembly

charger base parts list

ITEM	REORDER NO.	DESCRIPTION	QTY
1	7774-005933	CHARGER PCB ASSEMBLY	1
	7774-905934	CHARGER PCB ASSEMBLY (BOARD EXCHANGE)	
4	7774-903889	POWER CORD	1
10	7774-809516	FUSE WARNING LABEL	1
11	7774-154111	GROUNDING LABEL	1
12	7774-808625	MYLAR OVERLABEL	1
13	7774-303213	NO. 4-10 x ¼" SELF-TAPPING SCREW	2
14	7774-304849	NO. 6-32 x 1" MACHINE SCREW	5
15	7774-304864	NO. 4-10 x 5/16" FLAT HEAD SCREW	2
16	7774-304948	NO. 2-56 x ½" FLAT HEAD SCREW	2
17	7774-305002	STRAIN RELIEF	1
18	7774-305010	NO. 4-40 x ¼" FLAT HEAD CAP SCREW	1
19	7774-402429	POLE CLAMP BUMPER	1
20	7774-500131	PERMANENT FASTENER	1
21	NOT AVAILABLE	DOW CORNING 738 ELECTRICAL SEALANT	AR
22	7774-807528	WRITE-ON LABEL	1
23	7774-181007	SERIAL NUMBER LABEL	1
24	7774-807932	FUSE REPLACEMENT LABEL	1
25	7774-309996	COUNTERSUNK WASHER	1
26	7774-310010	POLE CLAMP SCREW	1
27	7774-310028	POLE CLAMP KNOB	1
28	7774-310036	SLIDE LATCH	1
29	7774-310044	POLE CLAMP	1
30	7774-310051	BACK SHELL	1
31	7774-106327	CHARGER CONNECTOR/WIRE ASSEMBLY	1
32	7774-310127	POLE CLAMP SPRING	1
33	7774-310499	FRONT SHELL ASSEMBLY	1
34	7774-311034	EXTERNAL CHARGER LABELS	1
34B	*	ANESTHETICS LABEL	*
34C	*	DIRECTION FOR USE LABEL	*
34D	*	RELEASE LATCH LABEL	*
34E	*	CHARGE ACTIVE LABEL	*
34G	*	CAUTION SHOCK HAZARD LABEL	*
36	7774-310788	CABLEWRAP	1
37	7774-157924	GROUND LABEL	1
34F	*	WARNING LABEL	1
38	7774-090026	3/16" DIA. SHRINK TUBING	AR

*PART OF ITEM 34 (7774-311034)


2
29
45
48
TOP OF LABEL
39
SECURE CABLE ASSEMBLY WITH TWO CABLE TIES. TIES MUST BE POSITIONED AS ILLUSTRATED ABOVE.
49
37
3
36
55
TOP OF LABEL
51
42
8
CABLE TIE POSITIONING DETAIL


33
57
34
44
56
31
46
33
30

5. final assembly (cont.)

pump parts list

ITEM	REORDER NO.	DESCRIPTION	QTY
1	7774-005925	PUMP PCB ASSEMBLY	1
	7774-905926	PUMP PCB ASSEMBLY (BOARD EXCHANGE)	
2	7774-105691	BATTERY PACK ASSEMBLY	1
3	7774-106350	SWITCH ASSEMBLY	1
4	7774-106335	MOTOR ASSEMBLY	1
7	7774-701085	TOUCH PANEL	1
8	7774-10634	PUMP CONNECTOR/WIRE ASSEMBLY	1
29	7774-809516	FUSE WARNING LABEL	1
30	7774-808120	CHARGE REQUIREMENT LABEL	1
31	7774-178003	MYLAR OVERLABEL	1
32	7774-303213	NO. 4-10 x ¼" SELF-TAPPING SCREW	3
33	7774-304849	NO. 6-32 x 1" MACHINE SCREWS	5
34	7774-304898	NO. 6-32 x ⅝" FLAT HEAD SCREW	2
35	7774-304906	M2x5 METRIC FLAT HEAD SCREW	3
36	7774-304914	NO. 4-10 x ¾" SELF-TAPPING SCREW	2
37	7774-304948	NO. 2-56 x ½" FLAT HEAD SCREW	2
38	7774-402460	QUAD RING	1
39	7774-500016	MINIATURE CABLE TIE	5
42	NOT AVAILABLE	DOW CORNING 738 ELECTRICAL SEALANT	AR
43	NOT AVAILABLE	DOW CORNING 7 RELEASE COMPOUND	AR
44	7774-809987	SERIAL NUMBER LABEL	1
45	7774-807528	WRITE-ON LABEL	1
46	7774-807536	FULL LINE LABEL	1
47	7774-807551	FUSE REPLACEMENT LABEL	1
48	7774-807890	BATTERY WARNING LABEL	1
49	7774-106368	BUZZER ASSEMBLY	1
51	7774-309798	CONNECTOR CLAMP	1
52	7774-309806	LOADING ARM LATCH	1
53	7774-106376	YOKE ASSEMBLY	1
54	7774-309830	FRONT CASE	1
55	7774-309848	BACK CASE	1
56	7774-309863	SHIELD	
57	7774-309871	BATTERY COVER	1
58	7774-310135	LOADING ARM LATCH SCREW	1
59	7774-310465	ROTOR ASSEMBLY	1

ITEM	REORDER NO.	DESCRIPTION	QTY
60	7774-310507	MOTOR SLEEVE ASSEMBLY	1
61	7774-310515	LOADING ARM LATCH SPRING	1
62	7774-310523	LOADING ARM ASSEMBLY	1
63	7774-310473	EXTERNAL PUMP LABELS	1
63A	*	RECYCLE LABEL	*
63B	*	LOADING ARM RELEASE LABEL	*
63C	*	ALARM TEST LABEL	*
63D	*	ALARMS LABEL	*

*PART OF ITEM 63 (7774-310473)

6. specifications

Type Infusion Device
Volumetric

Pumping Mechanism
Rotary Peristaltic

Pump Set Required
Sherwood Medical Kangaroo Feeding Pump Administration Sets.

Operating Range

Rate
1-75 ml/hr in 1 ml/hr increments
75-400 ml/hr in 5 ml/hr increments

Dose
1-75 ml in 1 ml increments
75-2000 ml in 5 ml increments

Interval
1-24 hours in 1 hour increments

Volume Delivered
1-9999 ml

Accuracy
+/– 10% of selected flow rate

Occlusion Pressure
12 psi (82.7 kPa) Nominal
15 psi (103 kPa) Maximum

Alarms
Internal Circuit Problem Alarm
No Set Alarm
System Error Alarm
Low Battery Alarm
Flow Error Alarm
Dose Delivered Alarm
Hold Error Alarm

Battery
Rechargeable NiCd 1800 mAh
Automatically charges when pump is placed on charging base connected to wall outlet. Recharge time for fully discharged battery is approximately 6 hours maximum. Partially discharged batteries will take less time to fully charge (minimum 45 minutes).

A new battery, when fully charged, will operate for approximately 14 hours at 125 ml/hr.

Dimensions

Pump:	5.75″H x 3.81″W x 2.00″D (14.61 x 9.68 x 5.08 cm)
Pump with Charger:	6.25″H x 4.50″W x 4.60″D (15.88 x 11.43 x 11.68 cm)

6. specifications (cont.)

Weight

Pump:	Approximately 1.4 lb (635 g)
Charger Base:	Approximately 2.08 lb (944 g)

Case Material

ABS Plastic–FLAME RETARDANT

Power Requirements

120 VAC, 50/60 Hz, 1 Amp–North America, Japan, Hong Kong
220-240 VAC, 50 Hz, 0.5 Amp–Europe, Australia

Chassis to Ground Resistance <= 0.15 ohms
Leakage Current <= 100μA

Memory of Settings when Pump is OFF

16 hours for all settings

Operating Temperature

50° to 105° F (10° to 40° C) If Charging
40° to 105° F (5° to 40° C) If NOT Charging

Transport and Storage Temperature

32° to 122° F (0° to 50° C)

Accessories

The Kangaroo Pet enteral feeding system consists of:

Kangaroo Pet Feeding Pump with Charger Base 8884-350003

Kangaroo Pet Carrying Case with Frame 8884-350409

Kangaroo Pet Charging Cable 8884-350490

The Kangaroo Pet Feeding Pump is to be used only with Kangaroo Pump Sets.

7. troubleshooting guide

Listed below are some of the probable causes of alarm conditions and their corrections.

Symptom	Probable Cause	Corrections
No Set Alarm **(no SEt)**	Pump set has been improperly placed onto pump.	Check to make sure that only Kangaroo Pump Set has been placed onto the pump. Check to make sure that the pump set has been properly positioned on the pump.
Flow Error Alarm **(FLO Err)**	Feeding container is empty.	Refill feeding container. If feeding set has been in use for 24 hours, replace.
	Feeding tube or feeding set tubing is occluded.	Locate point of occlusion and correct. Note: occlusion may occur upstream or downstream from pump. • Feeding Container • Feeding Pump Set (control clamp closed) • Feeding Tube—feeding tube should be checked for obstruction.
	Drip chamber walls are coated with feeding formula.	Check to make sure formula is not preventing drop detector from proper operation. If formula cannot be removed from inside walls of chamber via chamber manipulation, replace feeding set.
	Sensor in upper drip chamber guide is blocked.	Check to make sure black surface of drip chamber guide is free of dried formula. Remove any deposits by using a cotton swab dampened with warm soapy water or isopropyl alcohol.
Low Battery Alarm **(LO bAt)**	Battery has been run down.	Insert pump into charger base and plug power cord into wall outlet.
Hold Error Alarm **(HLd Err)**	Pump has been left in the hold mode for over 2.5 minutes.	Press START/HOLD to silence alarm, then press START/HOLD again to restore flashing rate display, and press START/HOLD again to restart pump.
System Error Alarm **(SYS Err)**	Problem with rotor, rotor position sensing or other rotor circuit problem.	Return pump for technical service.
Internal Circuit Problem Alarm **(8 8 8 8)**	Problem with internal pump circuitry.	Return pump for technical service.
Dose Delivered Alarm **(dOSE dEL)**	Preset dose has been delivered to patient.	Repeat the dose amount by clearing the volume delivered; OR cancel the dose feature by pressing DOSE and CLR; OR to feed additional volume, increase the dose amount by pressing DOSE, then ▲ until new dose is displayed; OR turn the pump off.

8. factory service/ordering information

A. In the event that it is necessary to return a unit for repair, please observe the following:

1. Call Customer Service at (800) 448-0190 for Authorized Return Number and shipping instructions.
2. Pack the instrument carefully and ship to:

Sherwood Medical Co.
98.6 Faichney Drive
Watertown, NY 13601

B. To place an order for repair parts or if technical assistance is required, call (800) 448-0190.

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sharing concern
for our environment SM
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